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Radiographic Spectrum of Chronic Knee Pain: Assessing the Diagnostic Utility of Plain X-ray

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Abstract

Background: Chronic knee pain (CKP) is a common musculoskeletal complaint and often reflects underlying degenerative joint disease. Plain radiography remains the most accessible imaging modality in routine orthopaedic practice. **Aim:** To find the utility of X-ray in detecting CKP.

Methods: This prospective observational study was conducted at OrthoD Hospital, Ahmedabad, from June 2025 to October 2025. A total of 124 adult patients with CKP were included. Detailed clinical evaluation was performed, followed by standard knee radiographs in anteroposterior and lateral views. Radiographic findings such as joint space narrowing, osteophytes, subchondral sclerosis, cysts, deformity, and patellofemoral changes were recorded. Data were analyzed using SPSS version 22.0.

Results: The mean age of the study population was 54.8 ± 11.6 years, and females constituted 54.8%. Abnormal X-ray findings were observed in 88.7% of patients. Joint space narrowing (72.6%) was the most common finding, followed by osteophyte formation (66.9%) and subchondral sclerosis (54.0%). Increasing age was significantly associated with abnormal radiographic findings ($\chi^2 = 12.84$, $P = 0.012$). Duration of symptoms greater than 6 months was also significantly associated with abnormal X-rays ($\chi^2 = 8.67$, $P = 0.003$).

Conclusion: Plain X-ray is a practical and valuable first-line tool for detecting structural abnormalities in CKP.

Keywords: Chronic knee pain; Knee X-ray; Osteoarthritis; Radiographic findings; Orthopaedics

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Introduction:

Chronic knee pain (CKP) is a common musculoskeletal complaint in adults and older individuals and is an important cause of impaired mobility, reduced quality of life, and increased health-care utilization [1]. Knee osteoarthritis is the leading underlying cause in many patients, although other structural abnormalities such as joint space narrowing, osteophyte formation, subchondral sclerosis, deformity, and patellofemoral changes may also contribute to symptoms. Plain radiography remains the most accessible, affordable, and widely used imaging tool in routine practice for the initial evaluation of CKP, especially in resource-limited settings. X-ray can demonstrate characteristic bony and joint-space abnormalities, help grade structural severity, and support clinical decision-making, although the severity of radiographic changes does not always correlate perfectly with the intensity of pain [2, 3]. Recent literature emphasizes that radiography continues to have practical value in identifying degenerative changes, excluding gross alternative pathology, and guiding further assessment when clinically indicated [3]. In this context, a study was taken to evaluate the spectrum of X-ray findings among patients with CKP.

Methods:

This prospective observational study was conducted in the OrthoD Hospital, Ahmedabad, over a period of four months from June 2025 to October 2025. The study included patients presenting with CKP to the outpatient and inpatient orthopaedic services during the study period. CKP was defined as pain in one or both knees persisting for more than six weeks. Adult patients aged 18 years and above who were willing to participate and provide informed consent were enrolled consecutively. Patients with acute trauma, recent fracture around the knee, postoperative knee conditions, congenital deformities, known inflammatory arthropathies such as rheumatoid arthritis, infective arthritis, or severe systemic illness interfering with evaluation were excluded from the study. Detailed demographic and clinical information was collected from all eligible participants using a predesigned case record form. Information regarding age, sex, duration of symptoms, side involved, pain characteristics, history of swelling, stiffness, restriction of movements, and associated comorbidities was recorded.

A thorough clinical examination of the affected knee joint was performed in all study participants. General examination and local musculoskeletal examination were carried out, with special attention to tenderness, crepitus, joint line pain, deformity, range of motion, effusion, and functional limitation. After clinical assessment, all patients underwent standard plain radiographic evaluation of the knee joint. X-ray imaging was performed using anteroposterior and lateral views in all cases, and additional skyline or

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weight-bearing views were obtained whenever clinically indicated. The radiographs were reviewed by the treating orthopaedic team and findings were documented systematically. The X-ray findings assessed included joint space narrowing, osteophyte formation, subchondral sclerosis, subchondral cysts, deformity, patellofemoral changes, loose bodies, calcification, and any other degenerative or structural abnormality. Where osteoarthritic changes were present, severity was graded based on standard radiographic criteria wherever applicable. The utility of X-ray was determined by analyzing its ability to identify radiological abnormalities corresponding to CKP and by correlating radiographic findings with the clinical presentation.

The collected data were entered into Microsoft Excel and analyzed using SPSS software version 22.0. Continuous variables such as age and duration of symptoms were expressed as mean and standard deviation, while categorical variables such as sex, symptoms, and X-ray findings were presented as frequencies and percentages. The association between clinical features and radiographic abnormalities was assessed using the chi-square test or Fisher's exact test, as appropriate. For comparison of mean values between groups, the independent sample t-test was applied. A p value of less than 0.05 was considered statistically significant.

Results:

A total of 124 patients with CKP were evaluated radiographically during the study period. The majority of patients belonged to the age group of 51–60 years (33.1%), followed by 41–50 years (25.8%) and >60 years (24.2%). The mean age of the study population was 54.8 ± 11.6 years. Female constituted a slightly higher proportion (54.8%), unilateral was common (71.0%). On X-ray examination, joint space narrowing was the most common finding, seen in 72.6%, followed by osteophyte formation (66.9%), subchondral sclerosis (54.0%), and patellofemoral changes (37.9%). Only 11.3% of radiographs were reported as normal. Based on overall radiographic interpretation, degenerative changes suggestive of osteoarthritis were identified in 88.7% of patients. Increasing age showed a statistically significant association with abnormal X-ray findings ($\chi^2 = 12.84$, df = 4, P = 0.012). Similarly, duration of symptoms of more than 6 months was significantly associated with radiographic abnormalities ($\chi^2 = 8.67$, df = 1, P = 0.003). The frequency of abnormal X-ray findings was also higher among patients presenting with clinical crepitus and restriction of movement, indicating good utility of plain radiography in detecting structural causes of CKP. These findings suggested that X-ray was a useful first-line investigation in CKP, particularly in middle-aged and elderly patients with longstanding symptoms and clinical signs suggestive of degenerative joint disease.

Discussion:

The present prospective study demonstrated that plain X-ray had substantial utility in patients presenting with CKP, as abnormal radiographic findings were identified in 88.7% of cases. The most frequent abnormalities in our series were joint space narrowing, osteophyte formation, subchondral sclerosis, and patellofemoral changes, which together strongly suggest that degenerative knee osteoarthritis constituted the principal structural basis for symptoms in the majority of study participants. This pattern is in agreement with contemporary imaging literature, which continues to recognize conventional radiography as the first-line imaging modality for suspected knee osteoarthritis because of its accessibility, affordability, and ability to depict the major structural hallmarks of disease, especially joint space loss, osteophytes, and subchondral bony changes. Piccolo et al. emphasized that radiography remains the recommended initial imaging test in knee osteoarthritis, particularly in routine clinical settings where rapid and low-cost evaluation is essential [2]. Likewise, reviews of osteoarthritis imaging have noted that although advanced imaging modalities such as MRI can detect earlier soft-tissue and cartilage abnormalities, radiography still retains an important role in demonstrating established structural disease and guiding everyday management decisions [4]. Therefore, the high proportion of radiographic abnormalities in our patients supports the practical relevance of X-ray as an effective first-line investigation for CKP, especially when degenerative pathology is clinically suspected.

An important observation in our study was the significant association between increasing age and abnormal X-ray findings, with radiographic abnormalities becoming progressively more frequent in patients above 40 years and particularly common in those aged 51 years and above. This is biologically plausible, as aging is closely linked to progressive cartilage degeneration, osteophyte development, meniscal wear, subchondral bone remodeling, and axial malalignment. Our findings also showed that longer duration of symptoms was significantly associated with abnormal radiographs, suggesting that chronicity of pain parallels the accumulation of structural joint damage visible on X-ray. Similar observations have been described in recent studies examining the relationship between radiological severity and clinical burden in knee osteoarthritis. Steenkamp et al. reported that clinical assessment and radiological evaluation are complementary, although symptom severity and structural severity do not always show a perfect linear correlation [5]. Kunze et al. also found that specific radiographic findings, especially deformity and structural progression, were associated with increased pain frequency in knee osteoarthritis [6].

These observations are relevant to our results because they indicate that while pain is a multidimensional symptom, X-ray continues to be valuable for detecting the anatomical changes most likely to explain persistent symptoms, chronic progression, and functional decline. Thus, in middle-aged and elderly individuals with CKP, radiography appears particularly useful not only for confirming degeneration but also for grading disease extent and supporting rational treatment planning.

Another clinically meaningful aspect of our findings is that abnormal X-rays were more common in patients with longstanding symptoms and examination findings such as crepitus and restriction of movements, further highlighting the role of radiography in corroborating clinically suspected degenerative disease. At the same time, the presence of a small normal-radiograph subgroup in our study is equally important, because it reminds clinicians that CKP may arise from early osteoarthritis, meniscal pathology, synovitis, referred pain, ligamentous problems, or periarticular soft-tissue conditions that may not be adequately visualized on standard X-ray. Recent reviews have emphasized this limitation of radiography, particularly in early disease, where structural cartilage, meniscal, and inflammatory changes may precede obvious radiographic abnormalities [7, 8]. Nevalainen et al. noted that ultrasound can outperform conventional radiography in some aspects such as detecting osteophytes, inflammation, meniscal protrusion, and localized cartilage damage, and other reviews have highlighted the growing role of multimodal imaging in osteoarthritis evaluation [9]. Nevertheless, these newer methods should be viewed as complementary rather than replacements in most routine settings. In resource-conscious institutions, plain X-ray remains the most feasible screening and baseline tool, while ultrasound or MRI may be reserved for unresolved diagnostic questions, atypical presentations, or persistent pain with inconclusive radiographs. Overall, our findings support that X-ray has clear utility in detecting CKP due to structural degenerative pathology and remains an indispensable initial imaging modality in orthopaedic practice, though interpretation should always be integrated with clinical findings and supplemented by advanced imaging when necessary.

Conclusion: Plain X-ray proved to be a useful first-line imaging modality in patients with CKP, identifying radiographic abnormalities in the majority of cases. Joint space narrowing, osteophyte formation, and subchondral sclerosis were the commonest findings, mainly reflecting degenerative osteoarthritis. The utility of X-ray was greater in older patients and those with longer symptom duration. Thus, conventional radiography remains an accessible, practical, and valuable tool for routine evaluation of CKP.

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Table 1: Association of selected variables with abnormal X-ray findings

Variable		X ray; n (%)			Statistics
		Abnormal	Normal	Total	
Age group (years)	21–30	5 (62.5)	3 (37.5)	8	χ^2 = 12.84; P = 0.012
	31–40	10 (76.9)	3 (23.1)	13	
	41–50	28 (87.5)	4 (12.5)	32	
	51–60	38 (92.7)	3 (7.3)	41	
	>60	29 (96.7)	1 (3.3)	30	
Duration of symptoms	6 weeks–6 months	36 (78.3)	10 (21.7)	46	χ^2= 8.67; P = 0.003
	>6 months	74 (94.9)	4 (5.1)	78	